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ASR - BIRD OBSERVATION PROGRAM AT GERMAN AIRPORTS

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Abstract

Bird counts, the basis of bird avoidance programs, provide excellent and detailed information about bird species, population sizes and their behaviour on and around airports. But, visual observation of birds is limited by astronomical and meteorological conditions, altitudes and distances and by their monitoring frequency.

In order to additionally obtain continuous and area covering information on bird activity in the closer vicinity of airports, the German Board of Bird Strike Prevention (DAVVL e.V.) started a program of bird radar detection at major airports in co-operation with the German Air Traffic Control Organisation (DFS GmbH), using a new generation of Airport Surveillance Radar (ASR-2000).

Within a distance of 10 nm around the local radar sensor, echoes of moving targets have been video recorded and computer stored in quarter-hourly intervals. Bird migration in regional scale and bird activity on a local scale could be detected, which gives interesting insights into the daily and seasonal activity pattern of birds around the airports.

The objective of the program, method and results as well as examples of the recordings will be presented.

Key Words: Surveys, Migration, Remote control, Radar, Electronic detection

1. Introduction

In the beginning of the 1990th the German Board of Bird Strike Prevention developed a video-monitoring system for bird migration, which can easily be attached to radar screens. This system has also been implemented at air defence radar sites and is still the basis of the bird migration observation network, however it will be replaced by a modern digital system by now. Nevertheless, the video camera system is independent from data links to the radar, and therefore easily attachable to any radar screens, even computer screens. This system has been described during former meetings and papers and will not be explained in detail.

The German Board of Bird Strike Prevention is issuing expertises to governmental and airport authorities and needs data on bird concentrations and movements in the close vicinity of the airports under study. Since about two years radar observations are carried out at Frankfurt Airport, Munich Airport and Düsseldorf Airport. Each site is equipped with a modern ASR-2000 Radar. These radar systems have proved to be able to detect radar targets in high resolutions, especially in the close vicinity.

This paper is a draft of results from a detailed study on bird activity at Munich Airport during the period 1.2.98 - 31.7.98. Some examples of recordings as well as statistical results are presented. Conclusions are made, based on this expertise and former studies in the wider area of Munich.

2. Method

Video data recording is performed in 15-minutes intervals, each having an echo recording time lapse of 5 minutes. The camera is attached to the computer screen of a radar maintenance unit. Each recording is saved in a data file and stored in weekly intervals on streamer tape. The filename contains date and time of the recording. Via modem link a permanent check and software maintenance is possible. Up to date recordings can be visualised.

The analysis of the data is done software supported by visualising each recording and assessing the main bird situation parameters. Recordings are to be displayed in movie mode.

3. Results

The map of Figure 1 shows roughly the area of detection around Franz-Josef Strauss Airport Munich, corresponding to the 10 nm range of the ASR. Important in this area is the Speichersee – Lake close to Ismaning, the flat moist agricultural land of the Erdinger Moos south and east of the airport, the Isar-River Crossing from southwest to southeast. Elsewhere hills with forest and agricultural landuse is dominating.

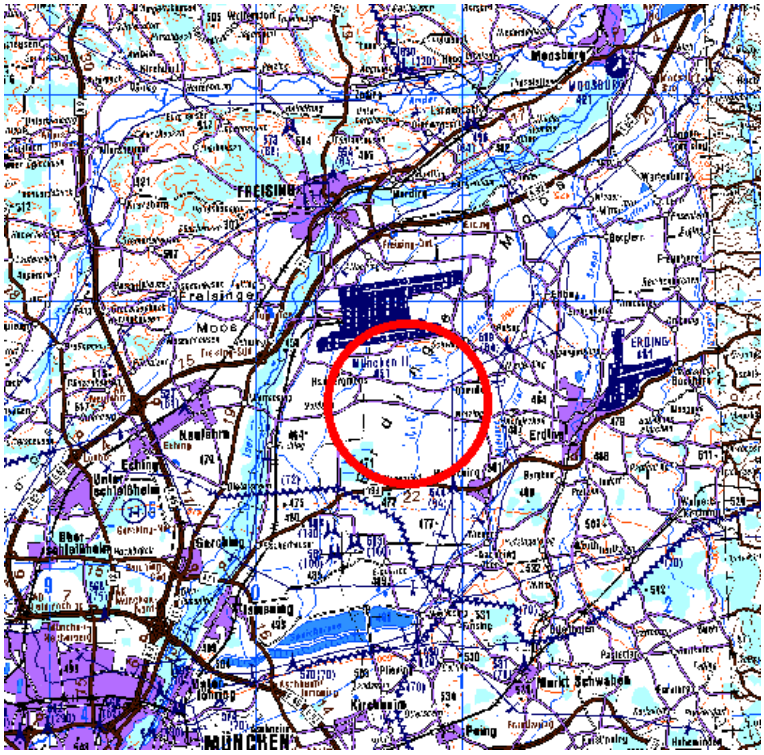


Figure 1. ASR-Location near Franz Josef Strauss Airport Munich. The Detection Range of 10 nm corresponds with the Map.

To give a brief impression on the quality of data and images, few examples of recorded images are shown in the figures below. Figure 2 is an example of remarkable bird migration with severe intensity close to the airport. Echo blanking is done in two segments to reduce bird clutter. The flight tracks of incoming and outgoing planes are still visible. Flight tracks of bird flocks are clearly visible in the northern part, most of them forming parallel bands of echoes. Close to the radar, which is located south of the runways, dense migration takes place, while crossing the other flight tracks. They are possibly in different altitudes.

Figure 2. Moderate bird migration intensity in diverging directions and speed.

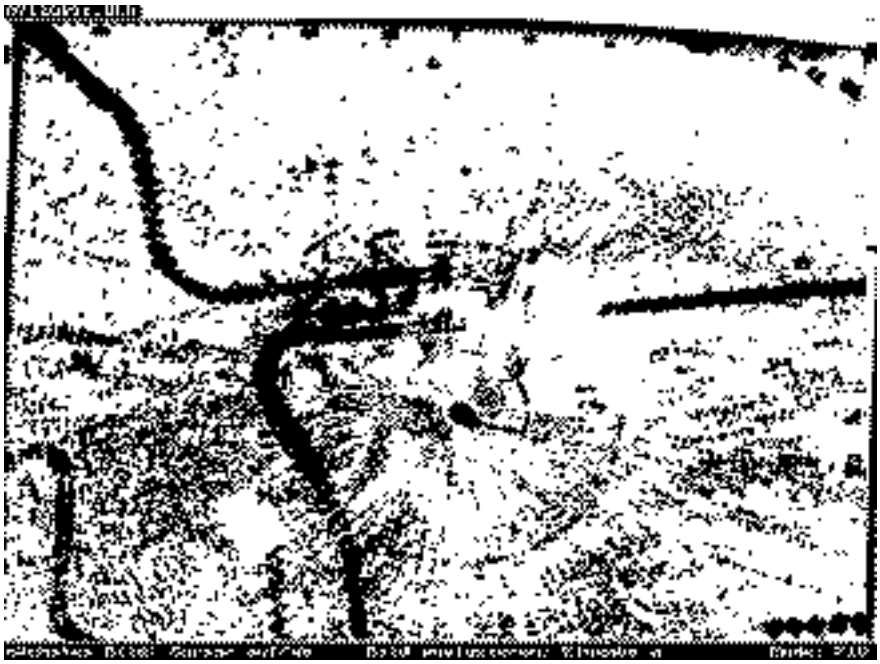


Figure 3. Bird echo clutter in summer during sunrise.

Migration patterns on time lapse exposure photographs are quite often shown, as they are easily recognisable. In Figure 3 however, one can see bird clutter which corresponds to local bird activity, visible as single echo clutter. It very often happens during sunrise in summer. Similar patterns also occur during the day in summer, when swifts and swallows are hunting for insects.

A good example of local bird movements is visible in Figure 4, displaying probably flocks from the Speichersee-Lake towards the agricultural land south of the airport during dawn. Such a situation is generally only visible in one or two images. There are several examples of such situations during sunrise or after sunset. It is a typical example for valuable information when studying bird behaviour in the vicinity of airfields. In the overall statistics, however, it is difficult to cope for these specialities. The movie display mode of image presentation reveals the details and therefore the image loops have to be studied carefully when studying a certain issue.

Figure 5 clearly displays dense flocks, crossing the runway north to south during December. This is a situation which occurs several times but only for a short period during this time of the year. It demonstrates, that this kind of information would be of real help when it could be available to the Ground Control Unit. Pilots should be aware of the dangerous situation during take-off and landing.

Figure 4. Short time movements of bird flocks during dawn.

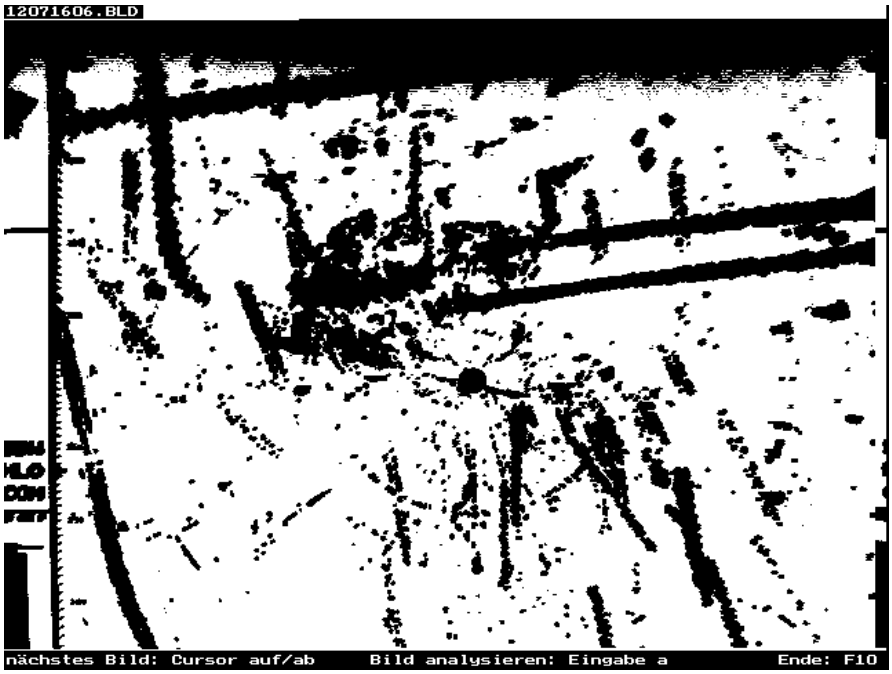


Figure 5. Dense Bird flocks crossing the flight paths north to south.

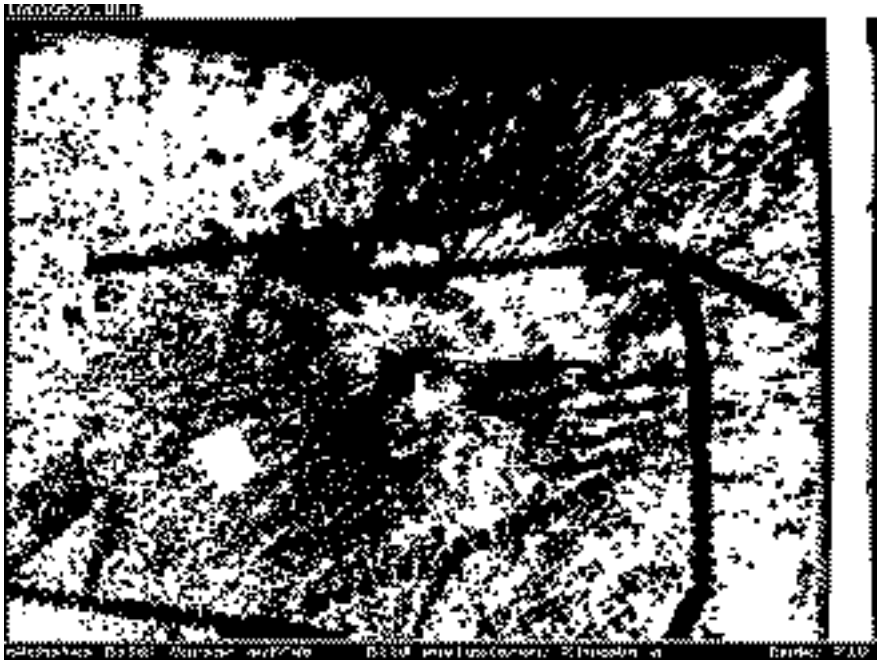
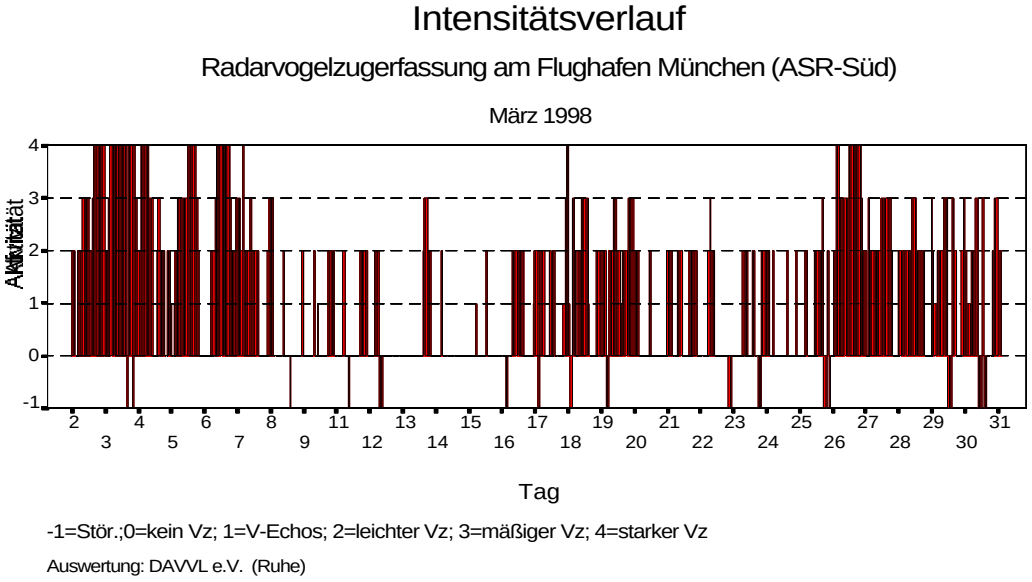


Figure 6. Severe bird migration during migration period.

Figure 6 gives an example of severe bird migration, lasting for several hours. This pattern is observed mainly during migration periods and often occurs during the first half of the night as well as during dusk and dawn. It will not be influenced by human activity but should be taken into consideration by flight safety control.

The seasonal pattern of bird migration is obtained by the time series analysis of the images and the analysed parameter. From other studies it is well known, that there are a few waves of extreme bird migration intensities, often influenced by the weather. The exact timing of the intensities is displayed in monthly sequences of bird migration intensities. When studied over several years, a probability of bird migration can be obtained, as far as the influencing factors are taken into account, e.g. weather parameter.

An example of a time series of bird migration around Munich Airport is given in Figure 7. One can recognise the main wave of migration during the first days of march and two short periods of extreme intensities later on. Light intensities of bird migration as well as bird echoes are often analysed.



-1 = Disturbance; 0 = No Bird Migration; 1 = Local Bird Clutter; 2 = Light Bird Migration; 3 = Moderate Bird Migration; 4 = Severe Bird Migration

Figure 7. Time series of bird migration intensities in March 1998.

Moreover daily cycles of bird intensities are computed and displayed on a monthly scale. These figures clearly show the times of the day, according to the season, during which dangerous bird concentrations likely occur. Statistics are also calculated for migration directions in the regional scale.

An interesting result however is obtained, when comparing bird strike incidents with the corresponding bird echo situation. Figure 8 shows the result of the comparison. All bird strikes that happened during the half year period that had been reported to the German Board of Bird Strike Prevention have been taken into account.

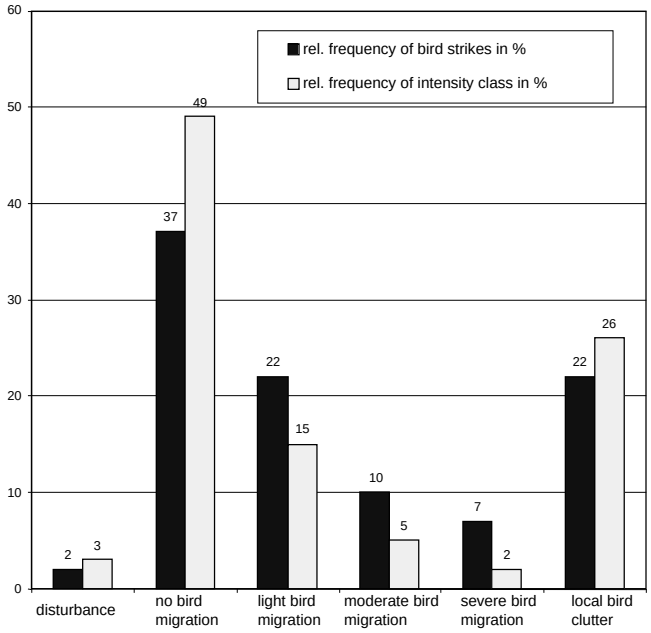


Figure 8: Comparison of bird strike and intensity class frequency.

The dark columns indicate the relative frequency of bird strikes during certain bird migration or echo intensities. The neighbouring bright columns show the relative frequency of the intensity classes itself. The comparison gives an indication of the risk of bird strikes at certain intensities, e.g. at moderate intensity the risk is twice, at severe intensity the risk is three times as high in getting a bird strike.

4. Remarks

The examples given above reveal the importance and the possibilities of radar observations in the close vicinity of airports, either for studying the general temporal and spatial pattern of bird migration, or for monitoring the local movements of birds. Results can be used for risk assessment and alarming the Bird Control.

These results demonstrate, that online radar observation can improve flight safety substantially.

5. References

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